United States Patent

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[54] DUST-RETENTIVE ARTICLE

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Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 673,300, Oct. 6, 1967, abandoned.

[52] **U.S. Cl.**.....**117/122 R,** 15/104.93, 117/143 A, 117/155 UA, 117/161 UF

[51] **Int. Cl.**.....**C09j 7/04**

[58] **Field of Search**.....15/104.93, 208, 209, 210; 117/139.5 R, 140 R, 155 UA, 161 UH, 1, 143 A, 161 UF, 122 R

[56] **References Cited**

UNITED STATES PATENTS

3,126,297	3/1964	Diamantopoulos et al.	117/161 X
3,141,304	7/1964	Moore	117/161 X
3,208,093	9/1965	Hansen	15/104.93

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[57] **ABSTRACT**

Dust-retentive articles, such as tack cloths, dust cloths, air filters, etc., comprise a porous web or sheet which is impregnated up to about 10 weight per cent with amorphous polypropylene of molecular weight in the range of up to about 10,000 and then dried at ambient temperature.

5 Claims, No Drawings

DUST-RETENTIVE ARTICLE

BACKGROUND OF THE INVENTION

This application is a continuation-in-part application of my copending application having Ser. No. 673,300, filed Oct. 6, 1967, now abandoned.

The use of tack cloths for the removal from various surfaces of dust, lint, and other forms of foreign matter is relatively well known. Such cloths find wide industrial applications such as, for example, the removal of foreign matter such as dust, grinding particles, sanding particles, or the like, from various objects or surfaces prior to the finishing operations thereof such as painting or varnishing. Although tack cloths have enjoyed wide industrial usage, they have heretofore been characterized by certain objectionable features which have discouraged their more universal use in the home or office.

Generally, a tack cloth comprises a textile material of relatively loose weave which has been chemically treated to give the same a sticky or tacky character. When such a treated cloth is rubbed over a surface, the undesirable foreign particles adhere to the cloth and are thus removed from the surface. Although the prior tack cloths were fairly efficient in removing the foreign particles, they were invariably characterized by the fact that the chemical coating tended to rub off onto the hands of the user so that the user's hands became undesirably sticky and messy. The use of such messy tack cloths was, of course, particularly objectionable in non-industrial applications, such as general dusting and cleaning in the house.

It is, therefore, one object of this invention to provide a dust-retentive article. It is another object of this invention to provide a porous or semi-porous article having high retention for finely divided solids and/or aerosols. It is another object of this invention to provide a non-messy dust-retentive article. It is yet another object of this invention to provide dust-retentive web which is non-messy, highly durable, i.e., retains its adhesive characteristics over a long period of time, and is easily regenerable.

SUMMARY OF THE INVENTION

In accordance with one embodiment of this invention there is provided a backing material such as porous or semi-porous web or sheet having dispersed thereon up to about 10 weight per cent amorphous polypropylene. In accordance with another embodiment of this invention a backing material such as porous or semi-porous web or sheet is rendered capable of retaining minute solids such as dust by dispersing thereon either in the form of solution or aerosol up to about 10 weight per cent amorphous polypropylene and drying at ambient temperature.

The term "tackifier" has commonly been given to the substance with which a textile is treated to render the same sticky or tacky. As already indicated above, a suitable tackifier must be tacky at normal temperatures and yet must be sufficiently stiff or viscous to adhere to the cloth and not come off on the surface being cleaned or the user's hands. Similarly, the tackifier should desirably be in the form of a liquid under manufacturing conditions so that the tack cloth may be simply and inexpensively fabricated by merely dipping the textile material in a bath of the tackifier or by spraying a solution of the tackifier onto the surface of a textile or absorbent paper material.

I have discovered that amorphous polypropylene within a certain molecular weight range meets all these requirements generally associated with tackifiers and filter impregnating agents when dispersed on a suitable web or backing in concentrations of up to about 10 weight per cent. Amorphous polypropylenes having a molecular weight above about 10,000 are solid and are only slightly tacky. Amorphous polypropylenes having molecular weights below about 10,000 are characterized by being semi-solid to liquid and are very tacky. Although dispersion of very minute quantities of this amorphous polypropylene on the intended backing materials increases their affinity for minute airborn solids, it is presently preferred that from about 0.5 to about 5 weight per cent of the amorphous polymer be employed. In addition, it is also preferred that the molecular weight of the amorphous polypropylene be within the range of from about 2,000 to about 8,000 in order to provide an article having the most desirable combination of qualities including dust retention and freedom from streaking or messy deposits of any variety. Polypropylene comprising at least about 90 per cent amorphous polymer is presently preferred.

Polypropylene is a synthetic resin which, of late, has enjoyed greatly increased usage in the preparation of molded articles, fibers and films. For use in the latter applications it is desirable that the polypropylene should have a highly crystalline structure which thereby serves to increase the strength of this versatile plastic.

Amorphous polypropylene is not readily usable for structural products because its properties are different from those of the crystalline polymer.

Many of the processes currently employed for the manufacture of polypropylene make use of so-called stereospecific catalysts which are chosen for their ability to produce predominantly crystalline polypropylene. However, despite the use of these catalysts, present polymerization techniques still produce a product with a significant proportion of amorphous polypropylene. The presence of this non-crystalline fraction detracts from the strength of articles manufactured therefrom. Therefore, it is the practice in the art to separate this amorphous portion from the crystalline material by solvent extraction. Only a few applications have been found for this amorphous polypropylene residue. Its inherent lack of high structural stability obviates its use in the preparation of fibers, films, and molded products, while any use of this material as an adhesive base is similarly precluded since the resulting adhesive films are exceedingly soft and display relatively little strength.

The use of such amorphous polypropylene in the production and bonding of non-woven fabrics is discussed in U.S. Pat. No. 3,126,297. It is well observed in that disclosure that the concentrations of amorphous polypropylene dispersed on the non-woven backing must be relatively high in order to effect the production of a unitary article. I have found that these concentrations are unnecessary. This consideration is pointed out particularly by the examples hereinafter presented.

The amorphous polymer is preferably applied to the backing in the form of a solution in a suitable solvent by either spraying the solution onto the backing or dipping the backing into a solution of the amorphous polymer. Amorphous polypropylene may be dissolved in a variety of solvents, including aromatic hydrocarbons, such as toluene, xylene, decahydronaphthalene and tetrahydronaphthalene; aliphatic hydrocarbons containing from five to 11 carbon atoms, such as pentane, hexane, and nonane; and chlorinated hydrocarbons, such as methylene chloride, carbon tetrachloride, trichloroethylene, perchloroethylene, and also chlorinated aromatic hydrocarbons such as chlorobenzene. It should be noted that, where so desired by the practitioner, it is possible to prepare these solutions with various combinations of any of the above-listed solvents. The resin solids content of these amorphous solutions should usually range from about one per cent to about 50 per cent by weight.

Aqueous emulsions can also be employed and are easily prepared by adding an emulsifying agent to a polymer solution. Suitable solutions can be prepared by any of the above-listed solvents. Water is then added with vigorous agitation, the amount of water added depending on the solids content desired in the resulting emulsion. The organic solvent can then be removed from the emulsion by any suitable method such as distillation. The resin solids content of these emulsions usually ranges from about two per cent to about 65 per cent by weight.

It should be mentioned that various additives, such as defoamers, resinous wet strength modifiers, lubricants, and the like, may be added to the amorphous polypropylene binder formulations.

Essentially, any variety of backing material, either non-porous, porous, or semi-porous, can be employed for the purposes of this invention. It is, of course, desirable to utilize some of these materials in preference to others depending on the particular application to which these finished articles were intended. For example, where it is desirable to produce an article suitable for application as an industrial tack cloth or dust cloth intended for household use a suitable backing material could comprise essentially any cloth fabric, natural or synthetic fiber in addition to preferably highly porous paper. However, the production of air filters would preferably require the utilization of a more structurally stable backing such as coarsely interwoven or fibrillated polymer fibers, fiberglass, comminuted solids, etc., which could be retained in a suitable frame or housing.

After application of the polymer to the backing, the dust-retentive article produced is dried at ambient temperature of about 50° to about 100° F. It has been found that elevation of the temperature at which the article is dried tends to decrease the tackiness of the article in relation to the degree of temperature elevation. Thus, by drying the article at an elevated temperature or by later heat treating a dust-retentive article that has been initially dried at room temperature, an article treated with amorphous polypropylene by this invention can be rendered so non-tacky that the improved dust-retentive characteristics are lost.

Another substantial advantage of the dust-retentive article of this invention, in addition to their high durability and relative lack of messiness, is the ease by which they can be regenerated after continued use. For example, industrial tack cloths, household dust cloths, air filters, and the like can be reimpregnated after a substantial period of use simply by applying additional amorphous polypropylene in the form of aerosol, for example, from an aerosol can, and allowing the solvent to evaporate.

The several advantages of this invention are listed in part by the following examples.

EXAMPLE I

A 12 by 18 inch paper towel was submerged in a solution of amorphous polypropylene having a molecular weight of about 5,000, drained, and dried at ambient temperature to produce a dust cloth having dispersed thereon 2 weight per cent amorphous polypropylene. The feel of this article was found indistinguishable from that of the original article. In addition, the treated cloth did not streak or leave any perceptible deposits on highly polished wooden surfaces and glass. It was, however, completely effective in removing dust deposits from these surfaces in a single pass.

EXAMPLE II

A 25 per cent solids solution of amorphous polypropylene was prepared using 58.3 grams of amorphous polypropylene, having a molecular weight of about 6,000, which was obtained from the xylene soluble fraction of production process polypropylene and had not been specially purified, and 174.9 grams of toluene. Three cotton cloths were saturated with the solution and air dried at ambient temperature, i.e., about 75° F. The cloths retained on their fibers approximately 14 grams of amorphous polypropylene per square foot. One cloth was thereafter placed in an oven at 280–300° F for one hour. The amorphous polypropylene solution treated cloth had a slight tacky feel. The cloth subjected to further heat had a dry feel.

EXAMPLE III

A dust-like material was prepared by drying soil at 325° F for 20 minutes and passing it through a 200 mesh screen. This dust was spread over a glossy table surface. A 12 square inch sample of each of the amorphous polypropylene coated materials was placed on the dusty surface without pressure for 10 seconds and removed without any wiping action. The polypropylene coated cloth that had not been heat-treated picked up more dust than the heat-treated cloth.

EXAMPLE IV

The test was repeated using fresh sample squares and applying the pressure of equal weights to each sample. The cloth that had not been heat treated readily picked up dust, substantially more than the completely untreated control cloth. The heat-treated cloth picked up dust no better than the completely untreated control cloth.

EXAMPLE V

Fresh squares of the heat-treated and non-heat-treated cloths were loaded with dust by wiping a dust coated surface. Both dust laden cloths were placed on clean surfaces. The heat-treated cloth readily released the dust. The non-heat-treated cloth retained almost all the dust it had picked up.

I claim:

1. A porous dust-retentive article comprising a porous backing having from 0.5 to about 10 weight per cent of liquid to semi-solid, tacky, substantially amorphous polypropylene of molecular weight within the range of about 2,000 to about 8,000 dispersed thereon, said amorphous polypropylene having been dried on said backing at ambient temperature.

2. The article of claim 1 wherein said amorphous polypropylene is evenly distributed throughout said backing.

3. The article of claim 1 wherein said polypropylene comprises at least about 90 per cent amorphous polymer.

4. The article of claim 1 wherein said backing is natural or synthetic fibrous webs.

5. The article of claim 4 wherein said backing is a porous paper.

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